

| | | | |
|--|-----|-----|-------|
| secular acceleration of <i>Mercury</i> | ... | ... | 0''·0 |
| secular acceleration of <i>Earth</i> | ... | ... | 3''·0 |

Details will shortly be published. It will be noted that the two entirely distinct methods of deducing a secular acceleration for the *Earth* are in close accordance. The zero result for *Mercury* is an argument against the cause being the resistance of the ether.

On the Ptolemaic Eclipses of the Moon recorded in the Almagest.
By P. H. Cowell, M.A.

The nature of the changes in the secular terms of the lunar and solar tables now in use, that I am advocating, may be described as follows :—

1. A correction of $-0''·6$ to the secular term of the longitude of the node to bring it into accordance with Professor Brown's calculations.
2. A correction of $-1''·6$ to the secular term in the mean elongation.
3. A correction of $+3''·0$ to the secular term in the argument of latitude.

In order to see what light the ancient lunar eclipses throw upon these corrections it will be remarked :

1. The position of the equinox does not enter into a lunar eclipse. We can only hope, therefore, to obtain from lunar eclipses the relative positions of the Sun, Moon, and node, and we cannot hope to get the position of the equinox in addition.
2. The present *Nautical Almanac* is based upon Professor Newcomb's researches. Mr. Nevill has already shown (*Monthly Notices*, vol. xxxix.) that the result obtained by Professor Newcomb was the consequence of what Mr. Nevill deems the excessive weight given to the first eclipse of the series. The proper remark, therefore, to pass upon my second correction is that it is in accordance with Mr. Nevill. I do not pursue this branch of the inquiry, for observations considered by Professor Newcomb to have a probable error of 20 minutes of time or $600''$ are not to be combined with observations of solar eclipses where a residual of $100''$ would not be tolerated.

3. A correction of $+3''·0$ to the secular term of the argument of latitude combined with $-1''·6$ to the mean elongation produces $+4''·6$ in the distance of the Sun from the node, on which depends the magnitude of the eclipse. Professor Newcomb has not discussed the magnitudes of the eclipses. In this connection I have made the following calculations :

Taking as a starting-point Professor Newcomb's table on p. 41 of his *Researches*, I have added or subtracted one-tenth of the difference in longitude to the Moon's latitude. In this

way I have found the Moon's latitude at conjunction in longitude; and I may add that this process is far more accurate than the roundness of the number would suggest. From the latitude at conjunction I took off $\frac{1}{2}$ per cent., and so formed the quantity "Hansen's ∇ ," or nearest approach of the centre of Moon and centre of shadow according to Hansen's tables.

To calculate the effect of my corrections on ∇ I first calculated the effect of Newcomb's corrections to Hansen, and then that of my corrections to the present tables.

$$\Delta\nabla = \pm \frac{100}{200} \left[\frac{1}{11} \Delta F - \frac{1}{10} \Delta D \right]$$

where $\Delta F = -20'' \cdot 05 T + 3'' \cdot 05 T^2$

$$\Delta D = -1'' \cdot 44 T - 1'' \cdot 44 T^2$$

for my corrections,

and $\Delta F = \Delta D = -29'' \cdot 17 T - 3'' \cdot 76 T^2$

for Newcomb's corrections.

It is clear that Newcomb's corrections to Hansen's ∇ are small, for Professor Newcomb did not alter the distance of the Sun from the node. My corrections to Newcomb's ∇ range from 5'.1 to 2'.4.

The radius of shadow is calculated from the formula $p + p' - \sigma$, when p , σ are given in the table on p. 41 of the *Researches* and p' is taken as 9". Lastly, the radius of the Moon was taken as $0.273 \times p$ and the magnitude of the eclipse as $\frac{\Sigma + \mu - |\nabla|}{2\mu}$,

$|\nabla|$ of course being taken positively.

In the following table the results are tabulated.

| Newcomb's Eclipse No. | Date. | Hansen's ∇ | $\Delta \nabla$ | | Radius of Shadow Σ | Magnitude of Eclipse. | | |
|-----------------------------|-------|----------------------|-----------------|-------|------------------------------------|-----------------------|------|-----------------|
| | | | N. | O. | | N. | O. | O. |
| 1 | -720 | + 6.8 | + 0.2 | + 5.1 | 39.9 | 1.58 | 1.41 | total |
| 2 | -719 | + 47.8 | + 0.2 | + 5.1 | 38.0 | 0.16 | 0.00 | 3 digits = 0.25 |
| 3 | -719 | - 43.5 | - 0.2 | - 5.1 | 45.3 | 0.55 | 0.40 | more than half |
| 4 | -620 | + 51.8 | - 0.2 | - 4.8 | 38.3 | 0.05 | 0.21 | 0.25 |
| 5 | -522 | - 41.1 | + 0.2 | + 4.4 | 38.5 | 0.45 | 0.60 | 0.5 |
| 6 | -501 | + 49.8 | - 0.2 | - 4.4 | 37.6 | 0.09 | 0.24 | 0.25 |
| 7 | -490 | + 57.7 | - 0.2 | - 4.4 | 42.1 | 0.01 | 0.15 | 2 digits = 0.17 |
| 8* | -382 | - 56.0 | + 0.2 | + 3.9 | 43.8 | 0.13 | 0.25 | small |
| 9 | -381 | + 44.2 | - 0.2 | - 3.9 | 38.6 | 0.31 | 0.44 | — |
| 10 | -381 | - 15.4 | + 0.2 | + 3.9 | 45.2 | 1.40 | 1.52 | total |

* In eclipse No. 8 Professor Newcomb has pointed out that the Moon with his corrections had already set. I regret to say that a similar remark applies to my corrections.

| Newcomb's Eclipse No. | Date. | Hansen's ∇ | ΔV | | Radius of Shadow Σ | Magnitude of Eclipse. | | |
|-----------------------------|-------|----------------------|------------|------|------------------------------------|-----------------------|------|-----------------|
| | | | N. | O. | | N. | O. | O. |
| 11 | -200 | +35'2 | -0'1 | -3'4 | 39'5 | 0.67 | 0.78 | partial |
| 12 | -199 | +13'4 | +0'1 | +3'4 | 42'5 | 1.41 | 1.30 | total |
| 13 | -199 | -6'6 | -0'1 | -3'4 | 42'6 | 1.62 | 1.51 | total |
| 14 | -173 | -40'9 | -0'1 | -3'3 | 45'4 | 0.64 | 0.53 | 7 digits = 0.58 |
| 15 | -140 | +52'9 | +0'1 | +3'2 | 45'2 | 0.27 | 0.17 | 3 digits = 0.25 |
| 16 | +125 | +55'7 | -0'1 | -2'4 | 42'6 | 0.09 | 0.17 | 0.17 |
| 17 | +133 | -24'1 | +0'1 | +2'4 | 39'1 | 1.00 | 1.08 | total |
| 18* | +134 | -28'7 | -0'1 | -2'4 | 39'5 | 0.85 | 0.77 | [0.33] |
| 19 | +136 | -48'5 | +0'1 | +2'4 | 44'6 | 0.38 | 0.46 | 0.50 |

It will be evident from the explanation, but it should be stated in close proximity to the table, that the columns headed "N." are not copied from Professor Newcomb, but are computations of my own to correspond with "Newcomb's corrections."

This table on the whole exhibits some slight evidence in favour of my correction to the distance between the Sun and the Moon's node. In fact, the error only amounts to 0.1 in the case of the first two eclipses. It will be noticed that in the first three eclipses we find the phrase: "is recorded as having occurred." In the other eclipses we find the more positive assertion: "occurred."

Observation of the Partial Eclipse of the Sun, 1905 August 29-30, at the Radcliffe Observatory, Oxford.

(Communicated by Dr. Arthur A. Rambaut, F.R.S., Radcliffe Observer.)

The time of first contact was well observed by Mr. Wickham, with a telescope which is permanently attached to the mounting of the 18-inch and 24-inch telescopes. The object-glass of this instrument is of 7 inches aperture, and its focal length is nearly 10 feet; the eyepiece employed was an ordinary solar diagonal of power 125.

Clouds had for some time prevailed, but fortunately for a short interval before contact the obscuration diminished, until only a very thin haze remained; through this the surface markings of the Sun's disc were neatly and clearly seen, and the limb was steady and sharply defined.

The first trace of indentation by the advancing limb of the Moon was easily detected, and the time registered by means of

* In eclipse No. 18 the observed magnitude was perhaps 0.67 and an error of copying has occurred.